1993 AQUATIC MACROINVERTEBRATE AND HABITAT SURVEY: NINEMILE CREEK, MISSOULA COUNTY, MT

submitted to

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prepared by

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May, 1995

Introduction

The Ninemile Creek drainage is one of several nonpoint source watershed improvement demonstration projects in Montana. Best Management Practices are being implemented in an attempt to reduce erosion and sedimentation in the watershed. The success of these programs will be measured, in part, by improved biotic condition in receiving streams. This approach uses changes in the biological integrity of the aquatic community to document improved water and habitat quality. To this end, annual surveys of aquatic macroinvertebrates and habitat in Ninemile Creek have been conducted since 1990. Previous surveys have been reported by (Bukantis 1990), U.S. Forest Service (1990), McGuire (1992) and Brooks (1993). This report presents the 1993 data and evaluates four years of monitoring. The objectives of this investigation were to: 1- provide a current assessment of Ninemile Creek's overall biotic condition, 2- evaluate the relative conditions in three stream reaches, 3- describe the degree and probable causes of biological impairment in these reaches, 4- compare data from 1990, 1991, 1992 and 1993, and describe any trends that indicate changing environmental condition.

Rationale

Aquatic macroinvertebrate communities consist primarily of immature insects, including stoneflies (Plecoptera), caddisflies (Trichoptera), mayflies (Ephemeroptera), true flies (Diptera), beetles (Coleoptera) and others. Evaluating the biological integrity of this assemblage can provide an assessment of environmental quality and can be used to identify limiting factors, for detecting impacts from physical alterations, sediment deposition, nutrients and toxicants, and to document successful mitigation of environmental degradation. Biological integrity has been defined as "the capability of supporting and maintaining a balanced, integrated, adaptive community having species composition, diversity and functional organization comparable to that of natural habitat of the region" (Karr and Dudley 1981). Macroinvertebrates are important components of aquatic ecosystems, and are the energy link between primary producers (algae), organic inputs to the stream, and fish. They are good indicators of environmental conditions due to their limited mobility, predictable associations with specific habitats, and differential tolerances to pollution.

Methods

Field work was conducted by Montana Water Quality Division (WQD) personnel during August of each year. The most recent survey was completed on August 2, 1993. Stream habitat was rated and aquatic macroinvertebrates were collected at three (upper, middle and lower) locations. In each reach, macroinvertebrates were collected from two riffles using standard traveling kick-net methods and 13 habitat parameters were scored using a modified version of the U.S. EPA Rapid Bioassessment Protocols (RBP) habitat assessment field data sheet.

Laboratory and data analyses were contracted to McGuire Consulting. Techniques described in the Montana RBP guidelines (Bukantis 1995) were used for both habitat and biological assessments.

Habitat data

Habitat was evaluated using 9 parameters in 1990, 12 parameters in 1991 and 1992, and 13 parameters in 1993 (Table 1). Only the nine metrics common to all years were used to evaluate temporal trends. Impairment classifications and graphic representations were expressed as a percentage of the maximum (135) possible score. Total scores for all parameters evaluated each year were calculated and were also presented as a percentage of the maximum possible score.

Macroinvertebrate samples

The 1993 macroinvertebrate samples were sorted using RBP III techniques (Plafkin et al. 1989) to provide approximately 300 organism subsamples. Organisms were enumerated and identified to the taxonomic level specified by the WQD (Bukantis 1995), usually genus or species. Tolerance values and functional designations used in metric calculations were those provided by Bukantis (1995).

RBP assessments provided numerical estimates of biological integrity. Selected metrics were compared to reference values and assigned scores ranging from 0 (severely impaired) to 6 (nonimpaired). The combined score of all metrics was expressed as a percentage of the maximum possible score and used as an estimate of biological integrity. Data from previous years were reviewed and, where necessary, recalculated to standardize data among years. Taxa richness and EPT richness metrics from 1990 were not directly comparable to data from subsequent years and, consequently, these metrics were excluded from RBP analyses of the 1990 data. The 1990 data were based on 100 organism subsamples and Chironomidae were identified only to family.

Assessments were made using two sets of criteria. The first assessment incorporated eight metrics: Taxa richness, EPT richness, Biotic index, % dominant taxon, % Collectors, % Scrapers and Shredders, % Hydropsychinae of Trichoptera, and % EPT. These metrics and the criteria used to assign metric scores (Table 2) represent the most recent RBP reference for Montana valley and foothill streams (McGuire 1995). This standardized characterization provided a general assessment of biological condition that is comparable with other streams in the valley and foothills ecoregion.

The second assessment provided a more discriminating evaluation of relative conditions within the study area. This analysis incorporated nine metrics that were considered the most appropriate for Ninemile Creek. For this analysis, the Community Tolerance Quotient (CTQa) was included along with the eight metrics used in the standard valley and foothill evaluation. Reference values used for this assessment (Table 3) represented the best (highest or lowest) value of each metric from the 12 reach assessments (mean values used when replicated) available for Ninemile Creek. The internal reference values generally provided a more rigorous standard of comparison than did the standard valley and foothill reference. Scoring criteria for this assessment were based on percent comparability to the reference value (adapted from McGuire 1994). Impairment classifications (Table 4) for both assessments were from Plafkin et al. (1989).

Results and Discussion

Habitat Assessment

During all four years, habitat was classified as optimal in the middle and upper reaches and sub-optimal in the lower reach (Table 1). Habitat classifications was based on the combined score of nine instream, bank, and riparian parameters common to all years. Additional parameters evaluated since 1990 did not change overall habitat classifications. Graphic comparisons (Figure 1) depict percentages of the maximum possible score for nine metrics.

From 1990 to 1993, habitat scores averaged 70, 90 and 91%, respectively, in the lower, middle and upper reaches. Habitat scores ranged from 65 to 73% in the lower reach. Ranges for the middle and upper reaches were 84 to 95% and 87 to 93%, respectively. No temporal trends in habitat quality were evident (Figure 1); however, the lowest habitat score recorded during this study occurred in the downstream reach during 1993. The sub-optimal habitat ratings for the lower reach were primarily attributable to channel alteration due to excessive bedload deposition and moderately unstable banks and instream substrates.

Macroinvertebrate Assessments

Macroinvertebrate identifications, enumerations, and metric values for the 1993 samples are presented in Appendix A.

Valley and Foothills Reference

Four years of data were compared to the most recent Montana Valley and Foothill streams reference (McGuire 1995). Based on this assessment (Table 5), biological integrity was nonimpaired in the upper reach and, on three of four dates, slightly impaired in the middle and lower reaches. Over four years, biointegrity scores averaged 74% for the lower and middle reaches and 91% for the upper reach.

Biological integrity appears to have declined in the lower reach of Ninemile Creek since monitoring began in 1990 (Figure 2). Biointegrity scores for this reach decreased each year since 1990 (Table 5). Brooks (1993), using different metrics and scoring criteria to evaluate three years of data, also noted a decline in this reach.

No temporal patterns were evident in the middle and upper reaches of Ninemile Creek (Figure 2). In the middle reach, scores ranged from 61% to 83% and slight biological impairment was generally indicated (Table 5). Biological integrity was classified as non-impaired on all dates in the upstream reach.

Ninemile Creek Internal Reference

A more sensitive assessment of relative biological conditions among stream reaches was made using reference values drawn from the Ninemile Creek data. This assessment ranked reaches and individual samples in the same order as the valley and foothill reference; however, it resulted in a wider range of scores (Table 6) which facilitated data interpretation.

Biological integrity was highest in the upstream reach. In 1993, the upper reach received a score of 100% compared to the Ninemile Creek internal reference criteria. During the four year monitoring period, biointegrity estimates averaged 86% and ranged from 70 to 100%. There were few indications of impairment in this reach. The relatively low score in 1991 (Table 6) was a due to relatively low EPT richness and a high relative abundance of blackflies in one riffle.

Biological impairment was more obvious in the middle and lower reaches where, respectively, scores averaged 58 and 61% of the internal reference (Table 6). Slight impairment of biological integrity was generally evident in the middle reach and the metrics indicating environmental stress were consistent each year. This reach has the lowest relative abundance of mayflies, stoneflies and caddisflies (% EPT), the lowest relative abundance of scrapers and shredders (functional feeding groups), and the highest biotic index among stream reaches. The relatively high biotic index and Community Tolerance Quotient (CTQa) indicated slight organic enrichment in this reach of Ninemile Creek.

The lower reach was characterized by reduced EPT and total taxa richness, skewed functional feeding group relative abundances, slightly elevated biotic index and a relatively high Community Tolerance Quotient on all dates. Since 1990, a reduction in EPT relative abundance, increasing biotic index values and a rising Community Tolerance Quotients have indicated declining biological integrity in this reach. Excessive sediment deposition was the most likely cause of impacts in this reach; although, slight organic enrichment may account for the decline in biological integrity during the study.

Table 1. Stream and riparian habitat assessment.

Stream: Ninemile Creek, Missoula County, MT

Location:	Lower				Middle reach				Upper reach			
Date:	Aug-90	Aug-91	Aug-92	Aug-93	Aug-90	Aug-91	Aug-92	Aug-93	Aug-90	Aug-91	Aug-92	Aug-93
Parameter												
P riffle development				14				18				15
P substrate	18	16	18	13	20	16	20	20	18	19	20	19
P embeddedness	18	18	18	15	18	19	19	20	19	19	19	19
P discharge/vel&depth	15	15	15	15	18	17	19	18	20	18	20	18
P canopy cover		13	12	10		16	8	15		17	15	14
S channel alteration	7	7	9	6	13	11	14	15	15	12	15	15
S substrate stability	7	11	8	5	13	12	15	15	14	14	13	14
S pool/riffle	11	12	9	13	14	12	13	14	13	12	14	14
S flow status				13				15				15
T bank stability	4	4	5	5	7	8	9	9	9	5	8	9
T bank cover stability	7	7	8	8	9	10	9	10	10	8	9	9
T grazing pressure		10	10			9	9			9	7	
T streamside cover	7	9	9	8	8	9	8	7	8	10	6	7
T riparian width		9	10	9		9	4	2		10	5	5
9 parameters (135 max)												
total score	94	99	99	88	120	114	126	128	126	117	124	124
% score	70%	73%	73%	65%	89%	84%	93%	95%	93%	87%	92%	92%
Classification	Sub	Sub	Sub	Sub	Opt	Opt	Opt	Opt	Opt	Opt	Opt	Opt
all parameters												
total score	94	131	131	134	120	148	147	178	126	153	151	173
% score	70%	75%	75%	67%	89%	85%	84%	89%	93%	87%	86%	87%
	Sub	Sub	Sub	Sub	Opt	Opt	Opt	Opt	Opt	Opt	Opt	Opt

Categories (9 parameters): Optimal >110, Sub-optimal 102-75, Marginal 66 - 39, Poor <31.
(% of total): Optimal >81%, Sub-optimal 75-56%, Marginal 49 -29%, Poor <23%.

Table 2. Metrics and scoring criteria for 300 organism RBP kick samples foothill and valley streams in Montana (McGuire 1995).

Foothill & Valley	Scoring Criteria			
metric	6	4	2	0
Taxa richness	>28	28-21	21-14	<14
EPT richness	>14	14-13	12 - 11	<11
Biotic index	<4	4 - 5	5 - 6	>6
% dominant taxon	<30	30-40	40-50	>50
% Collector-FFG	<60	60-75	75-90	>90
% Scrapers+Shredders	>30	30-20	20-10	<10
% Hydropsychinae of Trich.	<75	75-85	85-95	>95
% EPT	>60	60-45	45-30	<30

Table 3. Internal reference values for Ninemile Creek and Criteria for assigning scores to metrics based on percent comparability to reference values (adapted from McGuire 1994).

	Ninemile	Scoring Criteria				
metric	Reference	6	4	2	0	*
Taxa richness	38	>80%	80-60%	60-40%	<40%	a
EPT richness	22	>90%	90-80%	80-70%	<70%	a
Biotic index	2.5	>85%	85-70%	70-50%	<50%	b
% dominant taxon	11	>60%	60-45%	45-30%	<30%	b
% Collector-FFG	58	>80%	80-70%	70-60%	<60%	b
% Scraper+Shredder	37	>80%	80-60%	60-40%	<40%	a
% Hydro. of Trich	0	<50	50-70	70-90	>90	c
% EPT	66	>75%	75-50%	50-25%	<25%	a
CTQa	59	>90%	90-80%	80-70%	<70%	b

Internal reference values are the "best" values among Ninemile Creek samples.
* a = score is ratio of study site to reference X 100.
* b = score is ratio of reference to study site X 100.
* c = based on actual value, not a percentage of reference.

Table 4. Criteria for the assessment of biologically significant environmental degradation (Plafkin et al 1989).

% comp. to reference	Classification
>83%	nonimpaired
54-79%	slightly impaired
21-50%	moderately impaired
<17%	severely impaired

Table 5. Metric values and bioassessments for Ninemile Creek, Montana during August 1990 - 1993: standard Foothill and Valley reference (Table 2).

location:	lower				middle				upper			
metric year:	90	91	92	93	90	91	92	93	90	91	92	93
Taxa richness		26	20	25		35	32	34		30	33	38
EPT richness		14	13	12		18	17	18		19	18	22
Biotic index	3.4	3.8	3.9	4.3	3.8	4.0	4.1	4.1	2.5	3.2	3.4	2.8
% dominant taxon	35	37	37	27	27	21	22	34	20	28	22	11
% Collector-FFG	58	64	60	78	82	69	69	71	63	71	65	59
% Scrapers + Shredders	27	28	17	11	9	28	16	22	37	18	25	30
% Hydropsychinae of Trich.	0	69	15	0	33	36	55	15	9	6	4	4
% EPT	61	61	45	47	39	53	44	41	66	54	52	61
metric						score						
Taxa richness		4	2	4		6	6	6		6	6	6
EPT richness		4	4	2		6	6	6		6	6	6
Biotic index	6	6	6	4	6	4	4	4	6	6	6	6
% dominant taxon	4	4	4	6	6	6	6	4	6	6	6	6
% Collector-FFG	6	4	4	2	2	4	4	4	4	4	4	6
% Scrapers + Shredders	4	4	2	2	0	4	2	4	6	2	4	4
% Hydropsychinae of Trich.	6	6	6	6	6	6	6	6	6	6	6	6
% EPT	6	6	3	4	2	4	2	2	6	4	4	6
total score	32	38	31	30	22	40	36	36	34	40	42	46
% of reference	89%	79%	65%	63%	61%	83%	75%	75%	94%	83%	88%	96%
classification*	NON	SLI	SLI	SLI	SLI	NON	SLI	SLI	NON	NON	NON	NON

* classifications: (NON) nonimpaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired

Table 6. Metric values, percentage of reference, and bioassessments for Ninemile Creek, Montana during August 1990 - 1993 (composite internal reference- Table 3).

location:	lower				middle				upper			
metric year:	90	91	92	93	90	91	92	93	90	91	92	93
Taxa richness		26	20	25		35	32	34		30	33	38
EPT richness		14	13	12		18	17	18		19	18	22
Biotic index	3.4	3.8	3.9	4.3	3.8	4.0	4.1	4.1	2.5	3.2	3.4	2.8
% dominant taxon	35	37	37	27	27	21	22	34	20	28	22	11
% Collector-FFG	58	64	60	78	82	69	69	71	63	71	65	59
% Scrapers + Shredders	27	28	17	11	9	28	16	22	37	18	25	30
% Hydropsychinae of Trich.	0	69	15	0	33	36	55	15	9	6	4	4
% EPT	61	61	45	47	39	53	44	41	66	54	52	61
CTQa	63	74	77	81	82	78	79	82	59	65	70	60
% of reference												
Taxa richness		68	53	66		92	84	89		79	87	100
EPT richness		64	59	55		82	77	82		86	82	100
Biotic index	74	66	64	58	66	63	61	61	100	78	74	89
% dominant taxon	31	30	30	41	41	52	50	32	55	39	50	100
% Collector-FFG	100	91	97	74	72	84	84	82	92	82	89	98
% Scrapers + Shredders	73	76	46	30	24	76	43	59	100	49	68	81
% Hydropsychinae of Trich.	0	69	15	0	33	36	55	15	9	6	4	4
% EPT	92	92	68	71	59	80	67	61	100	82	68	81
CTQa	94	80	77	73	72	76	75	72	100	91	84	98
metric score												
Taxa richness		4	2	4		6	6	6		4	6	6
EPT richness		0	0	0		4	2	4		4	4	6
Biotic index	4	2	2	2	2	2	2	2	6	4	4	6
% dominant taxon	2	2	2	2	2	4	4	2	4	2	4	6
% Collector-FFG	6	6	6	4	4	6	6	6	6	6	6	6
% Scrapers + Shredders	4	4	2	0	0	4	2	2	6	0	4	6
% Hydropsychinae of Trich.	6	4	6	6	6	6	4	6	6	6	6	6
% EPT	6	6	4	4	4	6	4	4	6	6	4	6
CTQa	6	3	2	2	2	2	2	2	6	6	4	6
total score	34	31	26	24	20	40	32	34	40	38	42	54
% of reference	81%	57%	48%	44%	48%	74%	59%	63%	95%	70%	78%	100%
classification	NON/SLI	SLI	MOD	MOD	MOD	SLI	SLI	SLI	NON	SLI	SLI	NON

Figure 1. Habitat scores (%) for three reaches of Ninemile Creek, 1990 - 1993 (nine metrics).

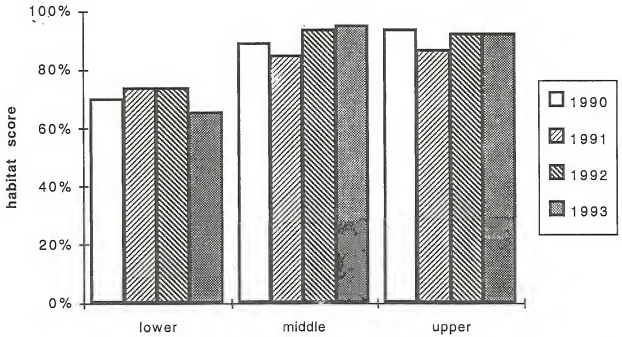
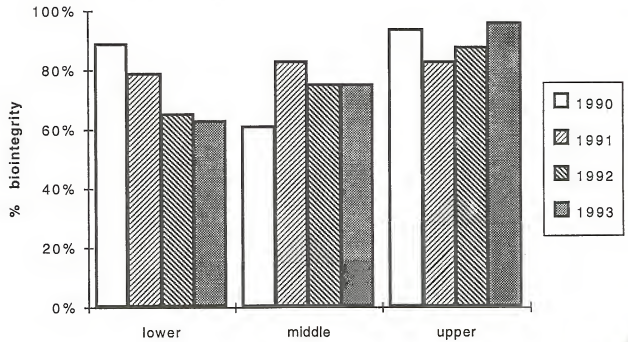


Figure 2. Biological integrity (% of reference) in three reaches of Ninemile Creek, 1990 - 1993.



Conclusions

1. Habitat classifications have been consistent over four years of monitoring. Overall habitat condition was considered optimal in the middle and upper reaches of Ninemile Creek and sub-optimal in the lower reach. The lowest habitat score recorded in four years of monitoring was in the downstream reach during 1993.

2. Habitat was optimal and biological integrity was non-impaired in the upstream reach on all dates.

3. Although habitat was considered optimal, biological integrity was slightly impaired in the middle reach of Ninemile Creek during all four years of monitoring. Slight organic enrichment was indicated in this reach.

5. Habitat was sub-optimal in the lower reach of Ninemile Creek. Excessive sediment deposition and an unstable stream bed reduced habitat quality and limited biological integrity near the confluence with the Clark Fork River.

6. Biological integrity was slightly to moderately impaired in the lower reach due, primarily, to habitat limitations. Biological integrity has declined in the lower reach each year since 1990. Biointegrity was moderately impaired in this reach during 1992 and 1993. Since habitat quality has remained fairly constant since monitoring began, declining water quality may have contributed to the reduction in biological integrity.

Literature Cited

Bukantis, R. 1990. Macroinvertebrate-based biological assessment of Ninemile Creek, tributary to the Clark Fork River. Mont. Dept. of Health & Environmental Sciences. Water Quality Bureau.

Bukantis, B. 1995. Rapid Bioassessment Macroinvertebrate Protocols: sampling and sample analysis SOP's. Draft Jan., 1995. Montana Department of Health and Environmental Sciences, Water Quality Bureau.

Brooks, L. 1993. Nonpoint source pollution control watershed improvement project: 1992 benthic macroinvertebrate and habitat assessment on Ninemile Creek, Missoula County Montana. Submitted to MDHES- Water Quality Bureau.

Karr, J. R. and D. R. Dudley. 1981. Ecological perspective on water quality goals. Environ. Manage. 11:249-256.

McGuire, D.L. 1992. Ninemile Creek; 1991 aquatic macroinvertebrate and habitat surveys. Prepared for the Montana Dept. of Health and Environmental Sciences/Water Quality Bureau.

McGuire, D.L. 1994. 1993 Habitat and aquatic macroinvertebrate surveys: Snowline Grazing Association, Beaverhead County, Montana. Prepared for the Montana Dept. of Health and Environmental Sciences/Water Quality Division.

McGuire, D.L. 1995. Montana statewide stream surveys: 1994 macroinvertebrate assessments. Prepared for the Montana Dept. of Health and Environmental Sciences/Water Quality Division.

Plafkin, J. L., M. T. Barbour, K.D. Porter and S. K. Gross. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. U.S. EPA. 444/4-89-001.

U. S. Forest Service. 1990. Nine Mile Creek: Macroinvertebrate analysis.

APPENDIX A:

NINEMILE CREEK
AQUATIC MACROINVERTEBRATE DATA

August 2, 1993

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - lower reach - Aug 2, 1993

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Ordobrevia sp.	1	0.3%	6	1.9%	1.1%
Optioservus spp.	54	17.5%	49	15.3%	16.3%
Zaitzevia parvula	6	1.9%	32	10.0%	6.0%
DIPTERA					
Pagastia sp.	2	0.6%	1	0.3%	0.5%
Cricotopus sp.	2	0.6%	1	0.3%	0.5%
Eukiefferiella spp.	4	1.3%	1	0.3%	0.8%
Parametriocnemus sp.	1	0.3%	1	0.3%	0.3%
Tvetenia sp.	3	1.0%	4	1.2%	1.1%
Polypedilum sp.	2	0.6%	8	2.5%	1.6%
Micropsectra sp.	0	0.0%	21	6.5%	3.3%
Hexatoma sp.	2	0.6%	2	0.6%	0.6%
Empididae	1	0.3%	0	0.0%	0.2%
Simulium spp. (Eusimulium)	101	32.7%	2	0.6%	16.3%
EPHEMEROPTERA					
Baetis tricaudatus	65	21.0%	66	20.6%	20.8%
Acentrella insignificans	5	1.6%	12	3.7%	2.7%
Attenella margarita	3	1.0%	1	0.3%	0.6%
Serratella sp.	3	1.0%	3	0.9%	1.0%
Nixe sp.	9	2.9%	52	16.2%	9.7%
Rhithrogena sp.	1	0.3%	1	0.3%	0.3%
Paraleptophlebia sp.	0	0.0%	1	0.3%	0.2%
PLECOPTERA					
Chloroperlinae	1	0.3%	6	1.9%	1.1%
Pteronarcella sp.	6	1.9%	1	0.3%	1.1%
Claassinia sabulosa	0	0.0%	2	0.6%	0.3%
Hesperoperla pacifica	1	0.3%	10	3.1%	1.7%
Skwala sp.	24	7.8%	16	5.0%	6.3%
TRICHOPTERA					
Glossosoma sp.	0	0.0%	2	0.6%	0.3%
Brachycentrus occidentalis	7	2.3%	0	0.0%	1.1%
ANNELIDA					
Naididae	5	1.6%	20	6.2%	4.0%
% of sample used:	100%		50%		Mean

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - lower reach - Aug 2, 1993

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
TOTAL ORGANISMS	309		321		315
TAXA RICHNESS	24		26		25.0
EPT RICHNESS	11		13		12.0
BIOTIC INDEX	4.46		4.22		4.34
% DOMINANT TAXON	33%		21%		27%
% EPT	40%		54%		47%
% COLLECTORS (g+f)	85%		71%		78%
% SCRAPERS + SHREDDERS	5%		17%		11%
% Hydropsychinae of TRICH	0%		0%		0%
METALS TOLERANCE INDEX	4.56		3.47		4.02
% Baetidae of EPHEM.	81%		57%		69%
SHANNON DIVERSITY	3.04		3.58		3.31
EPT/(EPT + Chironomidae)	0.90		0.82		0.86
HBI- CTQa	84		77		81
% COLEOPTERA	20%		27%		23%
% DIPTERA	38%		13%		25%
% CHIRONOMIDAE	5%		12%		8%
% EPHEMEROPTERA	28%		42%		35%
% PLECOPTERA	10%		11%		11%
% TRICHOPTERA	2%		1%		1%
% multivoltine	61%		43%		52%
% univoltine	38%		54%		46%
% semivoltine	0%		4%		2%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	35%	2	1%	1	18%
% COLLECTOR-GATHERERS	50%	14	71%	16	61%
% SHREDDERS	2%	1	0%	1	1%
% SCRAPERS	3%	2	17%	3	10%
% PREDATORS	9%	5	11%	5	10%
Scraper/(Scraper+Filterer)	8%		96%		52%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - middle reach - Aug 2, 1993

sample:	2.1		2.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Cleptelmis ornata	1	0.4%	0	0.0%	0.2%
Lara avara	1	0.4%	3	0.9%	0.7%
Optioservus spp.	19	6.7%	44	13.6%	10.4%
Zaitzevia parvula	7	2.5%	6	1.9%	2.1%
DIPTERA					
Thienemannimyia gp.	0	0.0%	1	0.3%	0.2%
Pentaneura sp.	0	0.0%	1	0.3%	0.2%
Pagastia sp.	4	1.4%	16	5.0%	3.3%
Cardiocladius sp.	1	0.4%	2	0.6%	0.5%
Cricotopus sp.	2	0.7%	2	0.6%	0.7%
Eukiefferiella spp.	6	2.1%	2	0.6%	1.3%
Orthocladius sp.	9	3.2%	2	0.6%	1.8%
Rheocricotopus sp.	0	0.0%	1	0.3%	0.2%
Tvetenia sp.	8	2.8%	3	0.9%	1.8%
Polypedilum sp.	3	1.1%	28	8.7%	5.1%
Micropsectra sp.	21	7.4%	13	4.0%	5.6%
Hexatoma sp.	1	0.4%	0	0.0%	0.2%
Simulium spp. (Eusimulium)	123	43.6%	13	4.0%	22.5%
EPHEMEROPTERA					
Baetis tricaudatus	23	8.2%	39	12.1%	10.2%
Attenella margarita	0	0.0%	4	1.2%	0.7%
Serratella sp.	3	1.1%	1	0.3%	0.7%
Timpanoga hecuba	0	0.0%	3	0.9%	0.5%
Epeorus albertae	6	2.1%	22	6.8%	4.6%
Nixe sp.	4	1.4%	77	23.8%	13.4%
Rhithrogena sp.	2	0.7%	0	0.0%	0.3%
PLECOPTERA					
Chloroperlinae	6	2.1%	2	0.6%	1.3%
Pteronarcella sp.	1	0.4%	1	0.3%	0.3%
Pteronarcys sp.	3	1.1%	7	2.2%	1.7%
Claassinia sabulosa	1	0.4%	1	0.3%	0.3%
Hesperoperla pacifica	3	1.1%	9	2.8%	2.0%
Cultus sp.	3	1.1%	2	0.6%	0.8%
Skwala sp.	7	2.5%	3	0.9%	1.7%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - middle reach - Aug 2, 1993

sample:	2.1		2.2		Cum
Taxon	#	% RA		% RA	% RA
TRICHOPTERA					
Ceratopsyche spp.	2	0.7%	1	0.3%	0.5%
Arctopsyche sp.	2	0.7%	2	0.6%	0.7%
Apatania sp.	1	0.4%	0	0.0%	0.2%
Glossosoma sp.	1	0.4%	0	0.0%	0.2%
Brachycentrus americanus	2	0.7%	5	1.5%	1.2%
Brachycentrus occidentalis	1	0.4%	4	1.2%	0.8%
ANNELIDA					
Lumbricidae	1	0.4%	3	0.9%	0.7%
OTHER					
Turbellaria	4	1.4%	0	0.0%	0.7%
% of sample used:	25%		92%		Mean

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - middle reach - Aug 2, 1993

sample:	2.1		2.2		Cum
Taxon	#	% RA		% RA	% RA
TOTAL ORGANISMS	282		323		303
TAXA RICHNESS	34		33		33.5
EPT RICHNESS	18		17		17.5
BIOTIC INDEX	4.37		3.88		4.12
% DOMINANT TAXON	44%		24%		34%
% EPT	25%		57%		41%
% COLLECTORS (g+f)	83%		58%		71%
% SCRAPERS + SHREDDERS	7%		36%		22%
% Hydropsychinae of TRICH	22%		8%		15%
METALS TOLERANCE INDEX	4.26		3.26		3.76
% Baetidae of EPHEM.	61%		27%		44%
SHANNON DIVERSITY	3.43		3.84		3.64
EPT/(EPT + Chironomidae)	0.57		0.72		0.64
HBI- CTQa	91		73		82
% COLEOPTERA	10%		16%		13%
% DIPTERA	63%		26%		45%
% CHIRONOMIDAE	19%		22%		21%
% EPHEMEROPTERA	13%		45%		29%
% PLECOPTERA	9%		8%		8%
% TRICHOPTERA	3%		4%		3%
% multivoltine	72%		38%		55%
% univoltine	25%		57%		41%
% semivoltine	2%		5%		4%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	45%	4	6%	4	26%
% COLLECTOR-GATHERERS	38%	13	52%	15	45%
% SHREDDERS	2%	3	3%	3	3%
% SCRAPERS	6%	6	32%	3	19%
% PREDATORS	9%	8	7%	8	8%
Scraper/(Scraper+Filterer)	11%		84%		47%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - upper reach - Aug 2, 1993

sample:	3.1		3.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Heterlimnius sp.	5	1.6%	6	2.1%	1.8%
Lara avara	1	0.3%	3	1.0%	0.7%
Narpus concolor	0	0.0%	2	0.7%	0.3%
Optioservus spp.	26	8.4%	29	10.1%	9.2%
Zaitzevia parvula	12	3.9%	8	2.8%	3.3%
DIPTERA					
Thienemannimyia gp.	0	0.0%	1	0.3%	0.2%
Pentaneura sp.	0	0.0%	1	0.3%	0.2%
Pagastia sp.	4	1.3%	4	1.4%	1.3%
Brillia sp.	0	0.0%	1	0.3%	0.2%
Cricotopus sp.	2	0.6%	3	1.0%	0.8%
Eukiefferiella spp.	5	1.6%	2	0.7%	1.2%
Orthocladius sp.	9	2.9%	4	1.4%	2.2%
Rheocricotopus sp.	0	0.0%	1	0.3%	0.2%
Thienemanniella sp.	2	0.6%	2	0.7%	0.7%
Tvetenia sp.	12	3.9%	11	3.8%	3.8%
Micropsectra sp.	6	1.9%	6	2.1%	2.0%
Simulium spp. (Eusimulium)	26	8.4%	12	4.2%	6.4%
EPHEMEROPTERA					
Baetis tricaudatus	27	8.7%	29	10.1%	9.4%
Drunella coloradensis	2	0.6%	5	1.7%	1.2%
Drunella doddsi	7	2.3%	8	2.8%	2.5%
Serratella sp.	27	8.7%	33	11.5%	10.0%
Cinygmula sp.	24	7.7%	41	14.3%	10.9%
Epeorus albertae	12	3.9%	11	3.8%	3.8%
Epeorus longimanus	20	6.4%	7	2.4%	4.5%
Rhithrogena sp.	3	1.0%	0	0.0%	0.5%
PLECOPTERA					
Chloroperlinae	2	0.6%	4	1.4%	1.0%
Malenka sp.	5	1.6%	0	0.0%	0.8%
Zapada cinctipes	0	0.0%	2	0.7%	0.3%
Pteronarcys sp.	3	1.0%	2	0.7%	0.8%
Hesperoperla pacifica	2	0.6%	1	0.3%	0.5%
Isoperla sp.	0	0.0%	1	0.3%	0.2%
Megarcys sp.	0	0.0%	2	0.7%	0.3%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - upper reach - Aug 2, 1993

sample:	3.1		3.2		Cum
Taxon	#	% RA		% RA	% RA
TRICHOPTERA					
Ceratopsyche spp.	4	1.3%	0	0.0%	0.7%
Arctopsyche sp.	4	1.3%	4	1.4%	1.3%
Apatania sp.	3	1.0%	6	2.1%	1.5%
Agapetus sp.	2	0.6%	3	1.0%	0.8%
Glossosoma sp.	6	1.9%	3	1.0%	1.5%
Micrasema sp.	1	0.3%	2	0.7%	0.5%
Dolophilodes sp.	10	3.2%	10	3.5%	3.3%
Rhyacophila betteni gp.	6	1.9%	1	0.3%	1.2%
Rhyacophila brunnea gp.	12	3.9%	8	2.8%	3.3%
Rhyacophila coloradensis gp.	0	0.0%	1	0.3%	0.2%
ANNELIDA					
Lumbricidae	3	1.0%	0	0.0%	0.5%
OTHER					
Turbellaria	16	5.1%	7	2.4%	3.8%
% of sample used:	25%		50%		Mean

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Ninemile Creek - upper reach - Aug 2, 1993

sample:	3.1		3.2		Cum
Taxon	#	% RA		% RA	% RA
TOTAL ORGANISMS	311		287		299
TAXA RICHNESS	35		40		37.5
EPT RICHNESS	21		22		21.5
BIOTIC INDEX	2.90		2.62		2.76
% DOMINANT TAXON	9%		14%		11%
% EPT	59%		64%		61%
% COLLECTORS (g+f)	60%		59%		59%
% SCRAPERS + SHREDDERS	28%		32%		30%
% Hydropsychinae of TRICH	8%		0%		4%
METALS TOLERANCE INDEX	2.76		2.50		2.63
% Baetidae of EPHEM.	22%		22%		22%
SHANNON DIVERSITY	4.58		4.49		4.53
EPT/(EPT + Chironomidae)	0.82		0.84		0.83
HBI- CTQa	63		58		60
% COLEOPTERA	14%		17%		15%
% DIPTERA	21%		17%		19%
% CHIRONOMIDAE	13%		13%		13%
% EPHEMEROPTERA	39%		47%		43%
% PLECOPTERA	4%		4%		4%
% TRICHOPTERA	15%		13%		14%
% multivoltine	35%		29%		32%
% univoltine	63%		69%		66%
% semivoltine	2%		1%		2%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	14%	4	9%	3	12%
% COLLECTOR-GATHERERS	46%	14	50%	14	48%
% SHREDDERS	3%	4	4%	6	4%
% SCRAPERS	25%	8	28%	7	26%
% PREDATORS	12%	5	9%	10	11%
Scraper/(Scraper+Filterer)	64%		75%		69%